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About the Cover

What may be another solar system 50 light years away is seen in this picture taken by astronomers at the University of Arizona and NASA's Jet Propulsion Laboratory, Pasadena, Calif. The charge-couple device (CCD) picture of Beta Pictoris shows a circumstellar disk of material extending 40 billion miles from the star, which is located behind a circular occulting mask in the center of the picture. The circumstellar material is probably composed of ices, carbonaceous organic substances and silicates. These are the materials from which the planets of our own solar system formed, and similar material may be associated with planet formation around Beta Pictoris.

The faint disk is seen nearly edge-on and is believed to be relatively young, possibly no more than a few hundred million years old. Analysis of the density of the ring material indicates that planets may have formed around the star. Extrapolating the distribution of material in the disk indicates that the interior particles in the disk must have been swept away — possibly by orbiting planets.

This photo was created by dividing an image of Beta Pictoris by that of a comparison star. (This process removes most of the interfering light scattered by Earth's atmosphere, but introduces certain artifacts such as the negative "dot" images of stars seen around the comparison star as well as the dark circular features around the dark occulting mask.)

The dark horizontal and vertical lines are fine silk filaments used to support the occulting mask. The observations were made by Dr. Bradford A. Smith at the University of Arizona and Dr. Richard J. Terrile of the Jet Propulsion Laboratory. They used a 100-inch telescope at the Las Campanas Observatory near La Serena, Chile, operated by the Carnegie Institution in Washington, D.C.

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Shuttle Mission 41-D — Pictorial Highlights

Crew: Henry W. Hartsfield, Commander
Michael L. Coats, Pilot
Judith A. Resnik, Mission Specialist
Steven A. Hawley, Mission Specialist
Richard A. Mullane, Mission Specialist
Charles D. Walker, Payload Specialist

Orbiter: Discovery (OV-103)

Launch Site: Kennedy Space Center, Fla., Pad 39A

Launch Date/Time: Aug. 30, 1984; 8:41 a.m. EDT

Orbital Inclination: 28.5 degrees

Altitude: 160 nautical miles

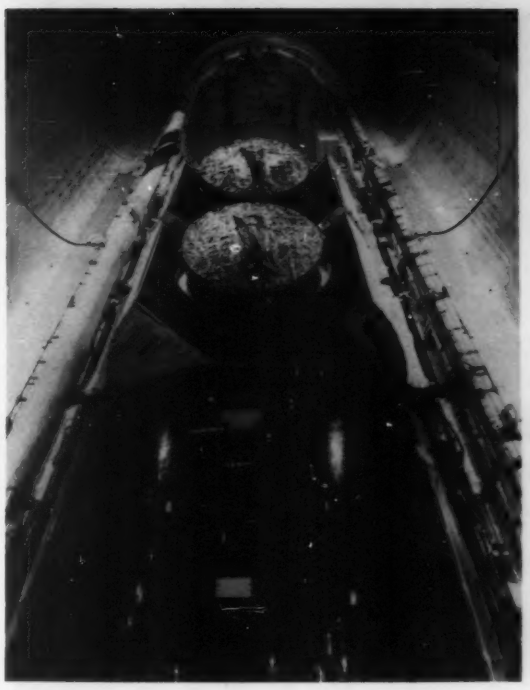
Mission Duration: 6 days, 56 minutes

Orbits: 96 full orbits; landing 97th

Landing Date/Time: Sept. 5, 1984; 9:38 a.m. EDT

Landing Site: Edwards Air Force Base, Calif., Runway 17

Mission Firsts:
First flight of Discovery
First commercial payload specialist
First flight of OAST payload
First "frisbee" deployment — Leasat



Crew breakfast (lower left); payloads in the cargo bay (from the top), OAST-1, SBS-D, Telstar 3-C and Syncom IV-2 (upper right); Discovery, poised on Pad 39A at sunset on the evening prior to launch (lower right).

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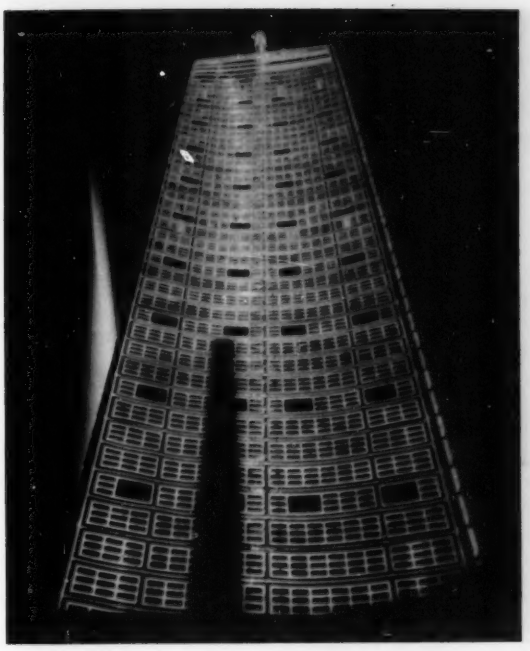
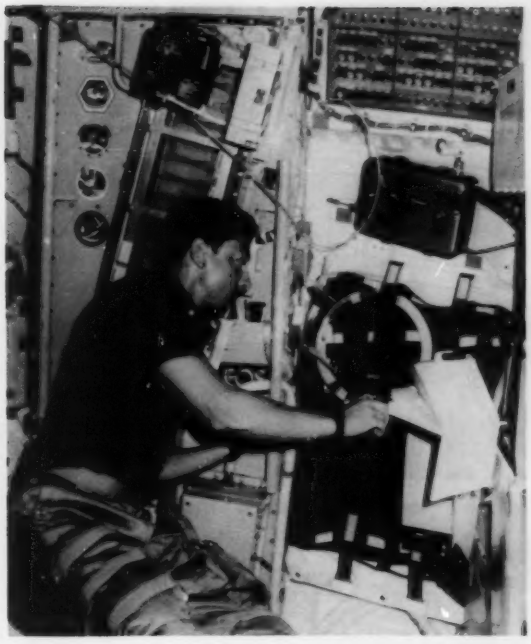
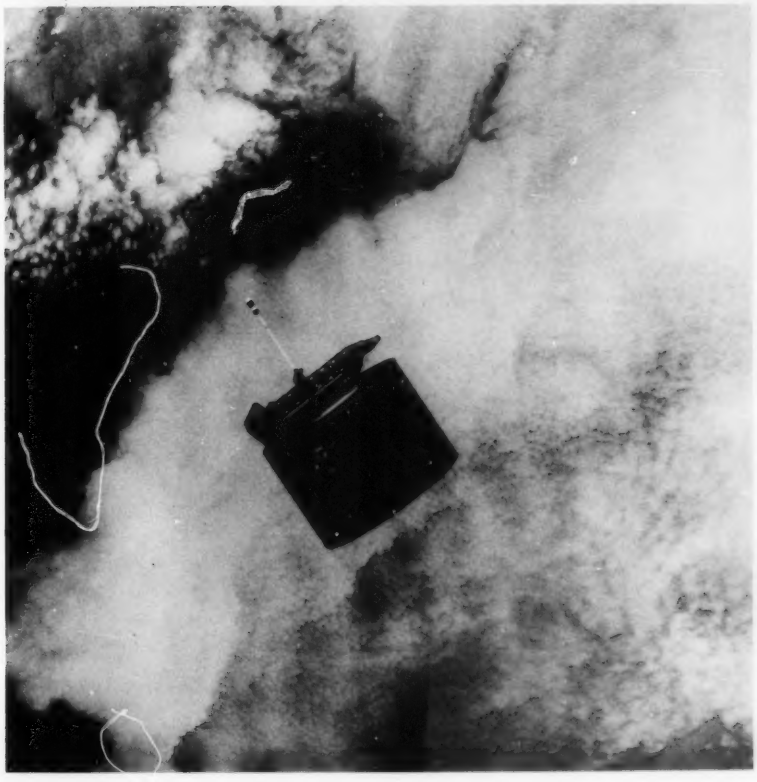
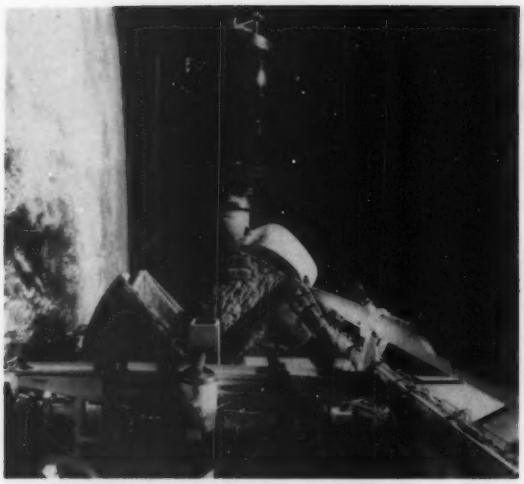
Two majestic birds prepare for flight — a great blue heron was startled from its perch in a lagoon south of Pad A moments before launch (left); Discovery's first launch at 8:42 a.m. EDT.



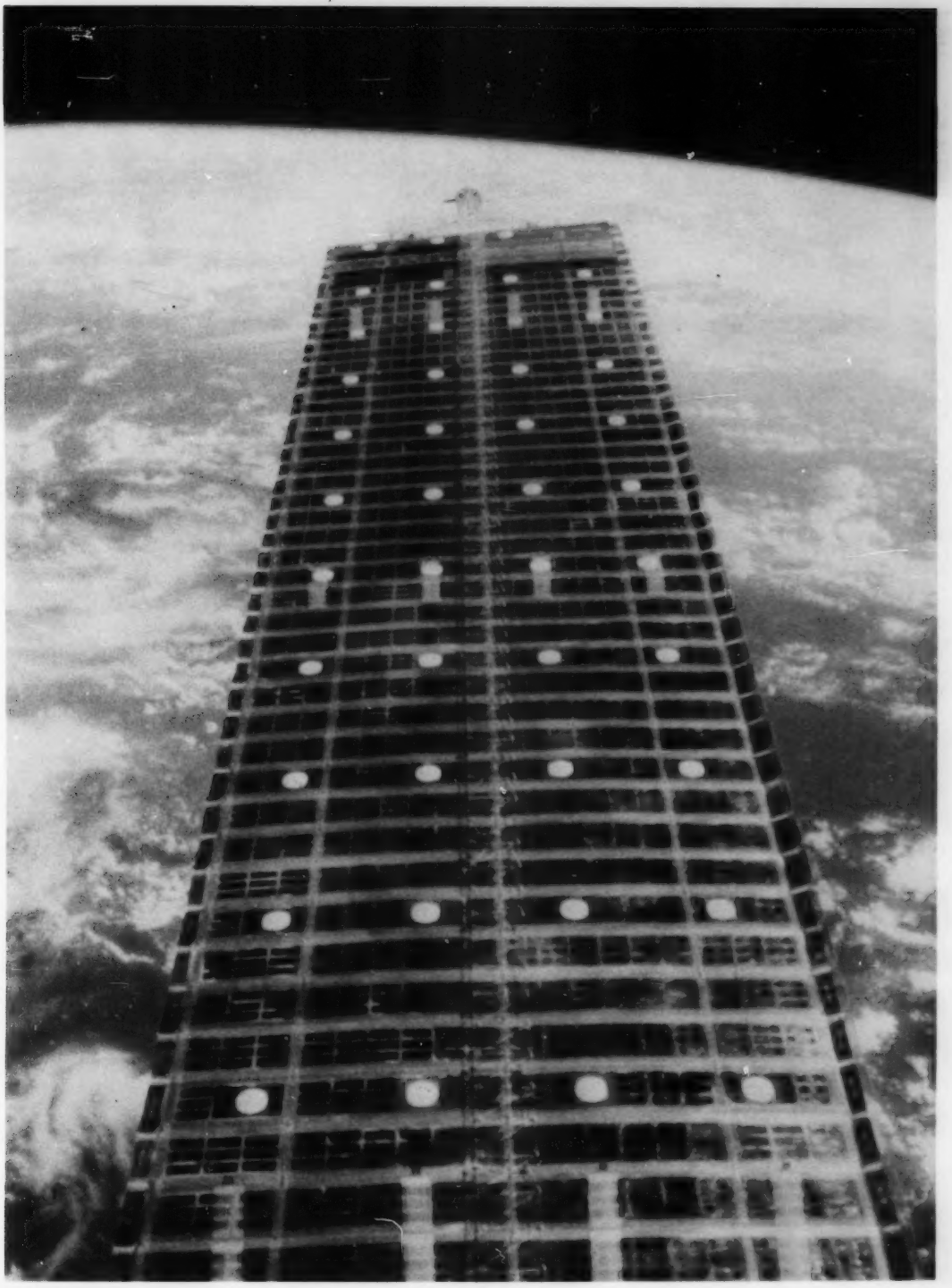


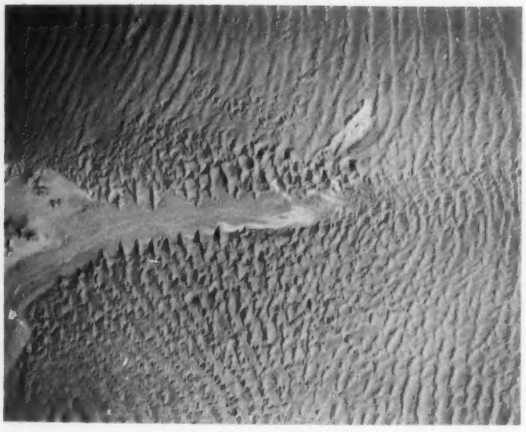


The OAST-1 solar array panel stands out against the darkness of space (upper left); the coastline of Angola forms the backdrop for this scene as Leasat separates from Discovery (bottom). Charles Walker closes a stowage area for biological samples supporting the Continuous Flow Electrophoresis System (upper right)

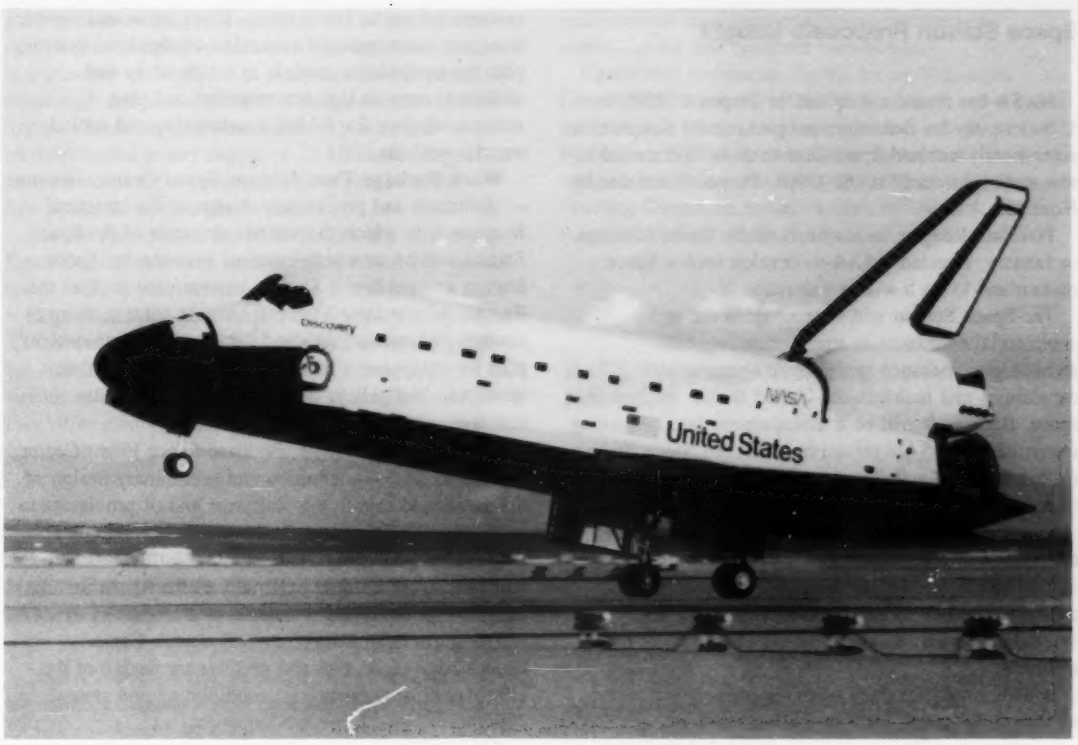


SBS-4 deployment on Aug. 30 (upper left); Telstar 3-C is launched on Sept. 1 (middle left); Hawley takes notes on lower deck (lower left); Resnik controls the unfolding of the Solar Array Experiment (upper right); Hartsfield photographs the Solar Array (lower right); the Solar Array reaches 100 percent extension (right).





41-D crew (upper left); Mullane floats at work station on the aft deck (middle left); Coats unloads sequences successfully filmed (lower left); Hartsfield loads IMAX film (upper right); thermal plume from the burning of agricultural fields in Rio Parana Basin of Brazil (middle right); sand dunes of Namib Desert (lower right).



Discovery just prior to touchdown on Runway 17 at Edwards Air Force Base, Calif. (above); crew completes quick walk around the orbiter after landing (left).

Space Station Proposals Sought

NASA has issued a Request for Proposal (RFP) to U.S. industry for definition and preliminary design of a permanently manned Space Station to be operational in low earth orbit early in the 1990s. Proposals are due by Nov. 15.

President Reagan, in his State of the Union Message in January, directed NASA to develop such a Space Station and to do it within a decade.

The Space Station will support scientific and commercial endeavors in space, stimulate new technologies, enhance space-based operational capabilities and maintain the United States' leadership in space. Because it will be a multipurpose facility serving many users, NASA's objective is that the Space Station be "customer friendly" and be dedicated to fulfilling customer requirements in its design and operation.

The RFP contains four "work packages" covering definition and preliminary design (Phase B) of Space Station elements. NASA plans to let competing contracts for each of the work packages and has scheduled April 1, 1985, as the effective date of the contracts.

In addition to the study of the permanently manned system, the Request for Proposal also requires contractors to study how those elements of the Space Station would change were the station initially man-tended rather than permanently manned. Contractors also will be expected to pay particular attention to recommendations of the NASA Advanced Technology Advisory Committee, which is identifying automation and robotic technologies which could be used in the Space Station.

Following completion of the 18-month definition and preliminary design contracts, NASA intends to move, in 1987, into final design and development of the Space Station. Proposers for the definition and preliminary design phase must have the capability to perform and manage the design, development and test phase (Phase C/D) of their appropriate work packages.

Because of the long lifetime of the Space Station and requirements for evolutionary growth and international participation, there will be no single prime contractor for the program. The overall system engineering and integration activities will be performed by NASA's Johnson Space Center, Houston.

The work packages and the NASA Centers responsible are:

Work Package One, Marshall Space Flight Center, Huntsville, Ala. — definition and preliminary design of pressurized "common" modules with appropriate systems for use as laboratories, living areas and logistic transport; environmental control and propulsive systems; plan for equipping a module as a laboratory and additional ones as logistics modules; and plan accommodations for orbital maneuvering and orbital transfer vehicles.

Work Package Two, Johnson Space Center, Houston — definition and preliminary design of the structural framework to which the various elements of the Space Station will be attached; interface between the Space Station and the Space Shuttle; mechanisms such as the Remote Manipulator Systems; attitude control, thermal control, communications and data management systems; plan for equipping a module with sleeping quarters, wardroom and galley; and plan for extravehicular activity.

Work Package Three, Goddard Space Flight Center, Greenbelt, Md. — definition and preliminary design of the automated free-flying platforms and of provisions to service, maintain and repair the platforms and other free-flying spacecraft; provisions for instruments and payloads to be attached externally to the Space Station; and plan for equipping a module as a laboratory.

Work Package Four, Lewis Research Center, Cleveland — definition and preliminary design of the electrical power generation, conditioning and storage systems.

Other NASA centers will support the definition and preliminary design activities.

The Kennedy Space Center, Fla., will be responsible for preflight and launch operations and will be involved in logistics support activities.

Launch of the Space Station elements and subsequent transportation between the station and Earth will be provided by the Space Shuttle.

A major objective of the Space Station program is to bring about participation of international partners as builders and users as well as to assist in Space Station operations. Funding for such international participation will be provided by other governments who will let their own definition and preliminary design contracts in phase with the NASA activity.

As part of the overall program, two or more unmanned free-flying platforms will be developed for use with the Space Station. A maximum of common subsystems such as power, thermal, docking, data, etc., will be used on both the Space Station and the platforms. The platforms will be tended and serviced by the Space Station in orbit. The platforms also will have the capability of being launched and serviced by the Space Shuttle in high inclination or polar orbits.

NASA's plans call for an initial Space Station to be operational in the early 1990s. It will be capable of

growth both in size and capability and is intended to operate for several decades, well into the 21st century. It is planned to be placed in a low earth orbit about 300 miles high and at an inclination to the equator of 28.5 degrees. It will include a number of pressurized modules and a power supply of 75 kilowatts, support a crew of six to eight people and have two or more free-flying unmanned platforms.

For the purposes of the RFP, NASA has selected a Space Station reference configuration called the "power tower." The power tower is one of a family of configurations that uses similar elements or components. The power tower family is considered a starting point for definition studies but is expected to undergo significant modifications as studies progress. Contractors may offer modifications within the reference concept family or other preliminary designs.

NASA Establishes Quality and Productivity Award

NASA Administrator James M. Beggs has announced the establishment of a new national award, the "NASA Excellence Award for Quality and Productivity." The first awards are expected to be presented in March 1986.

NASA will present the award to companies involved in NASA programs — both large and small — whose products exemplify the highest standards of performance. Beggs said, "Our award will recognize those organizations reflecting an attitude of constantly seeking out ways for improving its product quality.

"The decision to establish the Excellence Award is in keeping with one of NASA's highest goals — leadership in the development and application of practices which contribute to high quality and productivity." He added, "There is wide recognition of the need to focus technical attention on this very significant U.S. issue.

The criteria for the award was formulated by a team composed of NASA, industry and university personnel. Both large and small businesses involved in NASA programs as prime contractors, subcontractors and suppliers providing hardware, services and/or software are eligible. The candidate must have a yearly business volume with NASA of at least $50,000, or 10 percent of total business on a NASA contract. Candidates must nominate themselves through a letter, five pages or less, postmarked no later than April 1, 1985. Evaluation criteria are: productivity improvement and quality enhancement processes; quality and productivity achievements; and customer satisfaction.

Candidates verified as eligible by an Evaluation Committee, composed of NASA personnel and selected professionals from outside government, will be notified by June 1, 1985. Selection of the annual award recipients will be made by a NASA Productivity Steering Committee based on their review and recommendations of the Evaluation Committee.

NASA Program Advancing Composite Flight Research

As part of its continuing effort to develop the super-efficient airplanes envisioned for tomorrow, NASA has embarked on a new research program to show that a transport airplane's metal skin and supporting structure can be replaced with nonmetallic composite material to save weight and manufacturing costs. Reducing an aircraft's weight increases its fuel efficiency.

Work under this new phase of study represents the first application of composite materials in the construction of primary wing and fuselage structures for transport-class aircraft.

NASA's long-range goal is to provide commercial air transport manufacturers with the technology to produce composite structures and apply them on new aircraft, or on derivatives of current aircraft, in substantial amounts by the early 1990s. By the mid-1990s, researchers at NASA's Langley Research Center, Hampton, Va., where the new composites program will be managed, expect to see about 75 percent of the airframe structure of a transport made of composites.

Langley's Herman L. Bohon, manager of Langley's aircraft energy efficiency (ACEE) composites project office said, "If that should be the case, aircraft would be about 15 percent more fuel-efficient than today, just from the reduction in weight alone." Added Bohon, "A 15-percent reduction in fuel on a wide-bodied aircraft like a DC-10 or Boeing 747 represents a savings of 750,000 gallons of fuel each year. That begins to add up when an airline has a fleet of 100 to 200 aircraft."

Bohon cites ACEE program projections that transport wings made of graphite epoxy composites would average about 35 percent lighter than their aluminum counterparts, while a fuselage made of composites would be about 25 percent lighter.

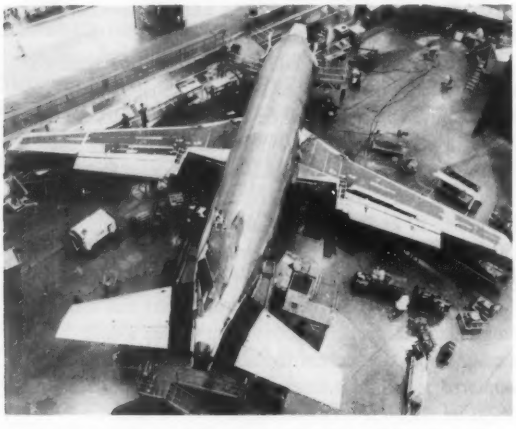
Composites also may reduce the manufacturing cost of transport aircraft. Bohon says the fuselage in

particular would benefit from composite construction through a dramatic reduction in parts and an equally dramatic reduction in labor-intensive work. Fitting and joining metal body sections around the fuselage of a transport now requires thousands of rivets and other parts, and fastening joints is largely done by hand. Composite construction may reduce the number of joints through fabrication of larger body sections, and eliminate rivets.

NASA's advanced composite structures technology is part of the agency's multicenter program—a cooperative effort with the nation's major transport airframe manufacturers: Boeing Commercial Airplane Co., Seattle; Lockheed-California; Lockheed-Georgia Co.; and Douglas Aircraft Co., Long Beach, Calif. Langley manages the ACEE composites program.

The airframe manufacturers will begin their contribution to the new initiative with a round of focused technology efforts. Through 1986, Douglas will study structural problems of fuselage areas with large cut-outs (as in the window belt area). Lockheed will document the structural performance under impact loads of a composite fuselage and study energy-absorbing designs for the lower fuselage. Boeing will work to improve the damage tolerance for composites. These are all areas of structures technology in which Langley has had a pioneering role.

Following these efforts, Boeing will incorporate the Lockheed and Douglas information with its own for a major fuselage design that, among other things, is to be highly damage-tolerant. NASA hopes by 1988 to have the design and manufacturing technology that will justify additional funding for subsequent fabrication and ground tests of full-size barrel sections to simulate structural behavior to impact and flight loads.



Now in flight service, this set of Boeing 737 tails was the first composite primary structure installed on a commercial aircraft.

The six-year Advanced Composite Structures Technology program builds upon a series of laboratory and commercial flight tests begun by NASA by 1976. The composites program achieved an important milestone this spring and summer when the first composite primary tail structure went into commercial flight service. Marking the conclusion of several years effort, five pairs of horizontal tails — called ship sets — have been installed on Boeing 737-200s.

Lockheed also designed and fabricated two L-1011 vertical tails, that will not fly. And by early next year, Douglas will have produced three DC-10 vertical tails, one of which will fly. Performance of the components in flight service will be monitored by the airlines for about 10 years.

NASA/ESA Mark 20 Years of Cooperation

Senior officials from NASA and the European Space Agency (ESA) met in September to review the progress achieved in the last 20 years in their collaboration of publicly available scientific and technical information (STI) and to chart future steps in this joint endeavor.

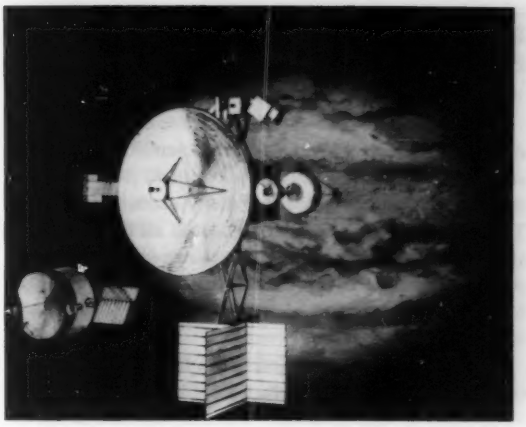
This exchange has proven to be an outstanding success. It has given broad exposure to a large number of scientific and techical reports that otherwise might have remained inaccessible and has made them available in both the United States and Europe. Over the years, the NASA/ESA relationship has evolved to fully reflect the objectives of both parties and to ensure that the cooperation remains effective and mutually beneficial.

The NASA system is managed by its Scientific and Technical Information Branch. The ESA system is managed by its Information Retrieval Service, installed at ESRIN (the former European Space Research Institute, which is now an ESA establishment located at Frascati, Italy).

Preparations for cooperation between NASA and ESA were begun even before the former creation of the European Space Research Organization (ESRO), the predecessor of ESA, with the work of COPERS, the European Preparatory Commission for Space Research. This effort was initiated by an exchange of letters in the spring of 1964 between NASA's Deputy Administrator, Dr. Hugh L. Dryden, and the Director General of COPERS, Professor Pierre Auger. Early STI cooperation involved the provision by ESRO of abstracts of European scientific and technical reports for publication in NASA's semimonthly announcement journal, "Scientific and Technical Aerospace Reports (STAR)." In return, NASA provided copies of STAR to

ESRO, and the two organizations exchanged both microfiche and full-size versions of publicly available reports.

In 1972, NASA and ESRO implemented the next phase of this cooperation — making the computer-based STAR and IAA (the published literature companion, "International Aerospace Abstracts") database available in Europe to organizations in the ESRO member states capable of providing suitable input to the NASA Information System. In addition, ESRO undertook to process (catalog, index, abstract, microfiche and prepare magnetic tapes in accordance with NASA's standards and procedures) European inputs for the NASA System. ESRO also agreed to provide English translations of certain technical report series issued by German and French organizations.



An artist's concept of the solar polar spacecraft.

International Solar Polar Mission Renamed Ulysses

The joint NASA/ESA (European Space Agency) International Solar Polar Mission (ISPM) has been renamed "Ulysses."

Proposed by ESA and concurred in by NASA, the name was chosen not only with reference to Homer's mythological hero, but also the Italian poet Dante's description (in the 26th Canto of this "Inferno") of Ulysses' urge to explore "an uninhabited world behind the sun."

The reference from the "Inferno" is appropriate because the mission will permit measurements to be made for the first time away from the ecliptic plane and over the poles of the sun — the mission's trajectory taking the spacecraft into the uncharted third dimension of the heliosphere.

Primary objective of the Ulysses mission is to investigate the properties of the solar wind, the structure of the sun/wind interface, the heliosphere magnetic field, the interplanetary magnetic field, the solar wind plasma, solar and galactic cosmic rays and cosmic dust.

Ulysses is scheduled to be launched into its unique elliptical transfer orbit to the planet Jupiter in May 1986. After a 14-month journey to Jupiter, the gravitational effect of the huge planet will deflect the Ulysses spacecraft into a high inclination orbit out of the ecliptic plane toward the sun.

Two and one-half years later it will pass over one of the poles of the sun. About eight months later it will re-cross the plane of the ecliptic on its way to the other pole. The entire Ulysses mission will last five years.

ESA's contribution to the Ulysses mission consists of the spacecraft and its operation and about one-half of the experiments. The other half of the payload and the spacecraft's power generator are provided by NASA. In addition, NASA will launch the spacecraft from the Space Shuttle, provide the Centaur injection stage and support the mission with its Deep Space Network. Mission operations will be performed from NASA's Jet Propulsion Laboratory in Pasadena, Calif.

Indian Payload Specialist To Fly On Shuttle

The Department of Space of the government of India has accepted NASA's offer to fly an Indian payload specialist aboard the Space Shuttle in connection with the flight of the Indian National Satellite Insat-1C in 1986.

The offer was extended to the Department of Space in January as part of NASA's policy of expanding opportunities for flight on the Shuttle of non-NASA personnel representing domestic and foreign sponsors of major payloads.

The Indian payload specialist will be an engineer or scientist from the Indian Space Research Organization (ISRO) of the Department of Space.

The Department of Space and NASA will work together to identify joint experiments that the Indian payload specialist might perform aboard the Shuttle.

Bacterial Enzyme may be Remnant of Early Evolution

The simplest version ever seen of one of life's basic enzymes has been found by NASA scientists in a salt-loving bacterium. Until now only one form of this energy-producing enzyme, ATPase (Adenosine Triphosphatase), was known to exist in all living systems. Researchers believe that the newly discovered ATPase may be leftover from early evolution. They hope it will provide a model for how early cells functioned.

The bacterium containing this simpler enzyme is one of a small group called Archaebacteria. It is one of three types of Archaebacteria. Another is found in the stomachs of cows, while the third grows in hot springs. These organisms differ from all other bacteria in many ways. For example, the RNA base sequences of the genetic code in the Archaebacteria show strong similarities to each other, but only vague similarities to the RNA in other bacteria.

The bacterium under investigation is extremely halophilic, which means that it thrives in a salty environment. Its growth in the San Francisco Bay salt ponds gives the ponds their red color.

NASA researchers are the first to locate the ATPase in the salt-loving bacterium. ATPase is associated with the highly complex process of energy transduction. No cell can function without carrying out this process.

The enzyme was discovered by researcher Larry Hochstein of NASA's Ames Research Center in Mountain View, Calif. According to Hochstein, ATPase must have had an early origin in evolution, since it performs an essential function and is found in all living creatures. The fact that only a very complex ATPase exists in present living systems led the Ames group to search for evidence of a simpler, earlier version.

The new findings show that the ATPase in the salt-loving bacterium has no more than four subunits, and it may have as few as two. This is significant, since the ATPase in all other living things has five subunits. These subunits, made of proteins, determine the structure and function of the enzyme.

Since the new-found version of ATPase may be a simpler precursor of contemporary ATPase, studying its unique properties may help piece together the puzzle of cell evolution.

NASA scientists still must establish how the ATPase works in the salt-loving bacterium. By comparing its function to the way in which these enzymes operate in other organisms, the researchers develop functional models for early cells. The ATPase is studied by breaking open a cell and separating the enzyme from the cell's other parts.

Hochstein and his colleagues Horden Kristjannson and Wijaya Altekar are beginning to study a second type of Archaebacteria in an attempt to confirm the current findings.

What's New in NASA Television and Radio Programming

Programs released in September:

Television

Aeronautics & Space Report (4½-minute and 90-second versions):

"Lost River System" (featuring Dr. Charles Elachi, Jet Propulsion Laboratory, and Kathryn D. Sullivan, 41-G mission specialist)

Radio

Space Story (4½-minute programs):

"Space Shuttle 41-G" (featuring 41-G astronauts Robert L. Crippen and David D. Leestma)
"Space Science Implanted" (featuring Alfred E. Mann, Pacesetter Systems, Inc.)
"Space Flight Participant Program" (featuring Patrick Templeton, NASA Associate Administrator for External Relations)
"Space Age Sensors for Your Heart" (featuring Dick Sharnitski, Heartrate, Inc.)

Special Report (14½-minute program):

"Space Flight Participant Program" (featuring Alan Ladwig, Space Flight Participant Program Manager, NASA Headquarters, and Patrick Templeton)

Copies of television tapes are sent simultaneously to all NASA Visitor Information Centers and Public Affairs Offices, and to 650 television stations nationwide as well as to 425 cable television systems via the satellite RCA-Cablenet 1. Five hundred television stations receive material formatted as a 4½-minute program; the remaining 150 stations receive a 90-second "spot" — a condensed version of the 4½-minute presentation.

NASA's radio programs are sent to approximately 3,500 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Released each month are one report of 14½ minutes and four 4½-minute weekly stories (one story in the set is featured for one week of the month). Ten one-minute space notes are released quarterly.

Contractor News

NASA has awarded a contract to an industry team headed by **RCA's Astro-Electronics Div.,** Princeton, N.J., for design, development and fabrication of the Advanced Communications Technology Satellite (ACTS). Other team participants are: **TRW Electronics Systems Group, Space Communications Div.,** Redondo Beach, Calif.; **Communications Satellite Corp. (COMSAT),** Washington, D.C.; **Motorola, Inc., Government Electronics Group,** Scottsdale, Ariz.; **Hughes Aircraft Co., Electron Dynamics Div.,** Torrance, Calif.; and **Electromagnetic Science, Inc.,** Norcross, Ga. The $260.3 million contract is awarded with work tasks split among the several contractor facilities. One of the primary goals of the ACTS program is to develop advanced satellite communications technologies, including satellite switching and processing technologies and multi-beam satellite antennas, using the 20 and 30 gigahertz bands. ACTS is scheduled for launch by the Space Shuttle in 1989 and will be used for advanced communications experiments. Lewis Research Center, Cleveland, manages the ACTS program for the Office of Space Science and Applications, NASA Headquarters, Washington, D.C.

Computer Sciences Corp. (CSC), Falls Church, Va., has been selected for the negotiation of a contract to provide computational analysis and programming support services for Langley Research Center, Hampton, Va. The $7.6 million cost-plus-fixed-fee contract has a potential lifetime of five years. Specific work will support basic and applied aerospace research through the Langley central computer complex, comprised of several large scientific computers and associated peripheral equipment that supports analytical and experimental research.

Lewis Research Center has selected **D-K Associates, Inc.,** Rockville, Md., for negotiations leading to the award of a contract for one year with options to extend over a total of five years. Estimated value of the first year of the cost-plus-award-fee contract is $2.2 million. Second and third year options are price at $2.6 million per year. Fourth and fifth years will be price if and when the options are exercised. The contract calls for D-K Associates to provide blueprint reproduction and drawing file maintenance; library services; reproduction services; print shop bindery services; photographic services; graphics, composing and editing; typing, word processing, keypunching and related clerical services; and miscellaneous administrative support services. All work will be performed at Lewis.

NASA Aerovan Visits Capitol Hill

AEROVAN II, one of Langley Research Center's two traveling exhibit units which tell the NASA aeronautics story nationwide, was recently on display on Capitol Hill in Washington, D.C.

On its first visit to Capitol Hill many federal legislators toured the AEROVAN to view some of the results of NASA's aeronautical research and technology, and to gain a better understanding of the future of aeronautics. Charles Nixon Jr., Legislative Affairs Specialist at NASA Headquarters, and H. E. Van Ness, Director of External Affairs at Langley, were available along with AEROVAN II lecturer William H. Gough to answer questions.

The AEROVAN is a walk-through trailer which features exhibits focusing on current aeronautical research in areas of safety, energy efficiency, environmental compatibility and improvements in passenger comfort and convenience. Other exhibits present NASA's role in our national security, future directions in aeronautics and how NASA's aeronautical research benefits the national economy.

More than 200,000 visitors have toured the AEROVANs this year. The AEROVAN program is managed for NASA by J. L. Associates, Inc., Hampton, Va.

Lecturer Bill Gough with AEROVAN II at U.S. Capitol.

Marshall Receives New Shuttle Booster Segments for Testing

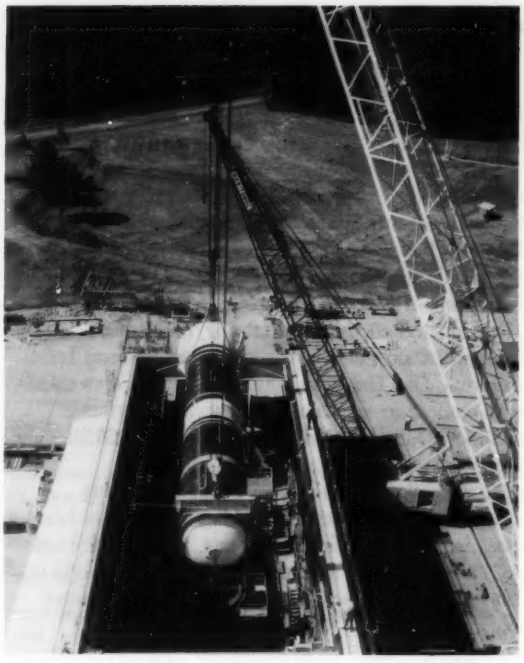
Plans to reduce the weight of the Space Shuttle's solid rocket motor cases — thereby increasing overall payload carrying capacity of the Shuttle — continued on schedule with the arrival at NASA's Marshall Space Flight Center, Huntsville, Ala., of two lightweight, filament wound motor case segments for testing.

The segments will undergo an extensive structural test program at Marshall beginning in November. That program is a major step in certifying the new motor cases for future Shuttle use.

The new cases are made of filaments from plastic reinforced with graphite fibers, wound into a cylinder. Each case weighs about 33,000 pounds less than the current steel motor case that makes up most of the length of the Shuttle's solid rocket booster. The motor cases hold the solid propellants that generate 1.9 million lbs. of thrust per booster at liftoff. The lighter cases will increase Shuttle payload carrying capacity about 4,600 lbs.

According to Marshall officials, the new cases are the largest structures of their type ever built. They are planned for use on some Shuttle missions beginning in 1985. The current metal cases will continue to be used on most missions where payload weight is not critical.

Preparation of the test segments included the installation of 670 strain gauges and 5,400 wires on the interior and exterior of the segments. These gauges and wires will provide 1,834 data channels during testing.



These filament wound motor segments are fabricated by Hercules, Inc., and Votaw Precision Tool, Inc., a joint venture, under subcontract to Morton Thiokol's Wasatch Division in Utah, prime contractor for the Shuttle solid rocket motor.

The test segments were transported by railcar from Utah to Marshall.

The first of two lightweight, filament-wound solid rocket motor case segments is delivered to Marshall; in the upper right photo, a booster test article containing two new case segments is lowered into the structural test stand.

Did You Know?

"The Art of Robert McCall" exhibition was opened to the public Sept. 26 at the National Air and Space Museum in Washington, D.C. The show contains 48 paintings and sketches, including portrayals of fantasy cities of the future, magazine and book illustrations documenting the early years of the United States and Soviet space programs, U.S. postage stamps featuring the American space program and concept sciences and promotional posters for the movies "2001: A Space Odyssey," "Star Trek: The Motion Picture" and "The Black Hole." McCall has covered the NASA program since 1958. He designed the mission patches on the uniforms worn by astronauts John Young and Robert Crippen at the first launch of the Space Shuttle Orbiter Columbia in 1981 and also created U.S. postage stamps to commemorate the event.

The 800th single engine test of a Space Shuttle was recently conducted at NASA's National Space Technology Laboratories in Bay St. Louis, Miss. The 100-second firing of engine 0207 increased the overall total number of seconds to 144,530 for the Space Shuttle Main Engine test program.

The Alabama Space and Rocket Center, Huntsville, Ala., will conduct an adult version of its popular U.S. Space Camp Oct. 19-21. The camp is open to men and women with a special interest in aerospace fields. The space museum anticipates hosting a series of programs for adults in the fall of 1985, based on the longer version of the camp which has attracted more than 4,000 youngsters in the past three years.

NASA Participates in EAA Convention and Fly-In

NASA was a major participant in the Experimental Aircraft Association's Annual Convention and Fly-In held July 28 through Aug. 4.

The small Wisconsin city of Oshkosh was the gathering place for nearly 800,000 aviation enthusiasts. The event, an international mecca for pilots, educators, private and industrial aircraft manufacturers, hobbyists, the aviation industry and federal aviation agencies, was an eight-day celebration of flight.

Visitors could stroll past acres of aircraft ranging from ultralights to war birds and antique classics to unusual experimental shapes. Breathtaking airshows were presented daily. Approximately 14,000 aircraft flew in for the event and 1,500 show planes were featured. About 1,200 foreign visitors from 63 countries attended, including a delegation from the People's Republic of China and individuals from the Soviet Union.

The NASA pavilion, a popular area, was centrally located, most of the Oshkosh audience passed through NASA's exhibition area. A large Technology Exhibition Tent featured exhibits focused on the theme, "Research Enhances Aviation Safety and Performance. Exhibits and display materials, grouped under subheadings of Aerodynamics. Propulsion, Structures and Operations/Human Factors, presented an overview of related NASA research. A special exhibit on SARSAT, the Search and Rescue Program was also on display. The Technology Exhibition Tent also housed a NASA theater, featuring video programs and lecture demonstrations. At the EAA Museum, a NASA exhibit sponsored by Wallops Flight Facility, presented a Real Time Information for Cockpit display.

Two static display aircraft were featured: Langley Research Center's Sundowner Stall/Spin research aircraft and Lewis Research Center's O2-A Cessna Skymaster equipped with a rotary engine.

The staff in the public information tent responded to thousands of queries regarding NASA programs. Twenty-three NASA researchers presented 13 well attended technical forums on a wide variety of topics. The Oshkosh audience is extremely interested in NASA aeronautical research and in the kind of technical information that NASA can provide.

An aerial view of the NASA exhibit area (top); a crowd views a Cessna Skymaster equipped with rotary engine.

NASA Equal Opportunity Program News

Last November when President Reagan signed a Proclamation declaring 1983 to 1992 as the National Decade of Disabled Persons, he said, "Let us increase the economic independence of every disabled American." He urged a redication to help "win the battle for dignity, equally and increased economic opportunity for all Americans."

National Employ the Handicapped Week, Oct. 7 — was recognized as an opportunity to give impetus to the Decade of Disabled Persons. In recognition of National Employ the Handicapped Week, NASA has endorsed the President's call to action. In addition to its commitment and affirmative action program for the employment of handicapped individuals and disabled veterans, NASA is using cooperative education, summer employment, job training and a variety of other special recruitment efforts to find avenues to employment for the severely handicapped. Twenty-five severely handicapped students were employed under the 1984 NASA Summer Employment Program.

On Oct. 11, 1984, the U.S. Office of Personnel Management recognized James A. Biaglow, an aerospace engineer at Lewis Research Center, as one of the 10 Outstanding Handicapped Federal Employees for 1984. Biaglow was recognized for his achievements in engineering and for his contributions in promoting and developing sports programs for handicapped individuals in his community.

Biaglow checks installation of thermocouples and pressure probes of a high pressure combustor.

Fire Resistant Aircraft Materials Tested

New materials for use in aircraft interiors, developed by NASA's Ames Research Center, Mountain View, Calif., have proven to be significantly more fire resistant than previously tested materials.

NASA and the Federal Aviation Administration (FAA) have been conducting fireworthiness tests on two types of aircraft cabin wall and ceiling panels. Under one set of conditions, the first set of panels resisted ignition for more than six minutes. Previously tested panels, representing current aircraft materials, endured for two minutes.

The new panels are composed of face sheets made of fiberglass cloth imbedded in a polyimide resin and bonded to a polyimide-Nomex honeycomb core. The entire panels are overlaid with a fire-resistant transparent film of polyetherether ketone.

Another set of advanced panels have graphite fibers replacing the fiberglass strands and an advanced vinyl polystyrylpridine laminating resin as the face sheet. These panels will be tested at the FAA's testing center next year.

If these graphite panels were applied to a current wide-body aircraft, they would save about 600 pounds of interior weight, equivalent to the weight of two passengers and their luggage. It has been calculated that the costs associated with the installation of these new lightweight panels could be recovered in approximately two years.

The value of weight savings using composite graphite materials is also found in the newest transport aircraft using secondary and medium primary structures developed by NASA's Langley Research Center in Hampton, Va.

In the test, an instrumented C-133 aircraft fuselage was lined with the fiberglass panels and subjected to an intense, external jet fuel fire representative of a post-crash, fuel-fed fire.

The test facility's instrumentation measured the time to flashover — the moment when most materials reach 957 degrees Fahrenheit and ignite — a life-threatening fire condition. The FAA intends to use such test results for updating jet transport fire safety standards.

Similar FAA full-scale testing of Ames-developed fire blocking layers over passenger and crew seat cushions was completed last spring to demonstrate the potential safety improvement available. The FAA has incorporated these test results in a Notice of Proposed Rule Making, proposing the requirement to retrofit existing seats with this new safety technology.

1984 Launch Activity

Space Shuttle Launches

Date	Mission	Orbiter	Launch Site*	Remarks
Feb. 3	41-B	Challenger (OV-099)	KSC	Payload: SPAS-01A, Palapa B-2, Westar-VI; successful launch; landing at KSC, Feb. 11.
April 6	41-C	Challenger (OV-099)	KSC	Payload: Solar Maximum Repair Mission; Long Duration Exposure Facility
Aug. 30	41-D	Discovery (OV-103)	KSC	Payload: LEASAT-1, Telstar 3-C, SBS-D, OAST-1; first flight of Discovery; successful.
Oct. 5	41-G	Challenger (OV-099)	KSC	Payload: OSTA-3, ERBS; successful.
Nov. 7	51-A	Discovery (OV-103)	KSC	Payload: MSL-1, Telesat-H, GAS Bridge
Dec. 8	51-C	Discovery (OV-103)	KSC	Payload: DOD Mission

Satellite Deployments from the Shuttle

Date	Satellite	Deployment Device/** Upper Stage	Shuttle Mission	Remarks
Feb. 3	Westar-VI	PAM-D	41-B	Western Union communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
Feb. 6	Palapa B-1	PAM-D	41-B	Indonesia communications: successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
April 7	LDEF	RMS	41-C	Long Duration Exposure Facility; successful deployment.
Aug. 30	SBS-D	PAM-D	41-D	Satellite Business Systems commercial communications; successful deployment
Aug. 31	LEASAT	UUS	41-D	Navy communications; successful deployment
Sept. 1	Telstar 3-C	PAM-D	41-D	AT&T communications: successful deployment
Oct. 5	ERBS	RMS	41-G	Earth Radiation Budget Satellite; successful deployment
Nov. 3	Telesat-H	PAM-D	51-A	Canadian communications
Nov. 4	LEASAT	PAM-D	51-A	Navy communications

Expendable Launches

Date	Mission	Launch Vehicle	Launch Site	Remarks
March 1	Landsat 5	Delta	WSMC	National Oceanic and Atmospheric Administration; earth observation; successful launch.
June 9	Intelsat V-G	Atlas Centaur	ESMC	Intelsat international communications; satellite not in proper orbit due to Centaur stage malfunction.
Aug. 16	AMPTE	Delta	ESMC	Active Magnetospheric Particle Tracer Explorer; space physics — NASA cooperative with Germany; successful launch.
Sept. 21	Galaxy-C	Delta	ESMC	Hughes commercial communications satellite.
Nov. 8	NOAA-F	Atlas-F	WSMC	National Oceanic and Atmospheric Administration weather satellite.
November	NATO-IIID	Delta	ESMC	North Atlantic Treaty Organization communications.

* **Launch Sites:** ESMC — Eastern Space and Missile Center, Fla.; KSC — Kennedy Space Center, Fla.; WSMC — Western Space and Missile Center, Vandenberg Air Force Base, Calif.

** **Separation Device/Upper Stage:** IUS — Inertial Upper Stage; PAM-D — Payload Assist Module; RMS — Remote Manipulator System; UUS — Unique Upper Stage.

Another Dividend from Air and Space

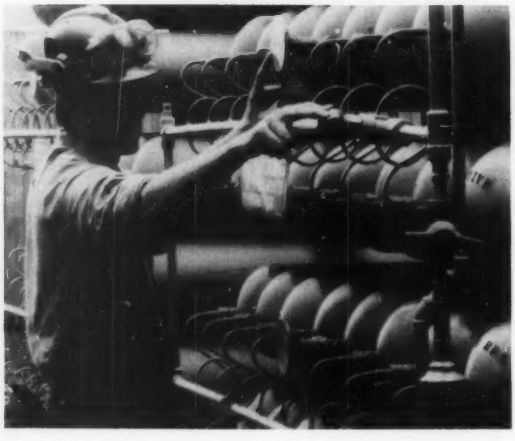
NASA
National Aeronautics and Space Administration

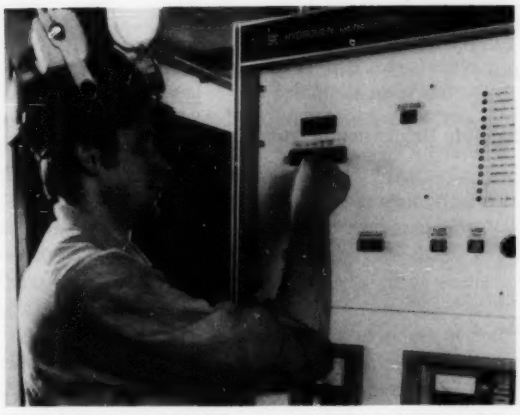
Research and development in aeronautics and space have provided numerous benefits for all Americans — and at a tiny percentage of the tax dollar. Here is an example:

Hydrogen Generator

At right is a spinoff system for producing hydrogen on site that went into operation late in 1982 at the Sewaren (N.J.) Generating Station of Public Service Electric and Gas Company (PSE&G). Called the ES-1000 Hydrogen Generator, the system was developed by General Electric Company's Aircraft Equipment Division, Wilmington, Mass. The hydrogen is used as a coolant for the station's large generators; on-site production eliminates the need for continuous resupply of hydrogen. Below, a technician is filling tanks with hydrogen produced by the ES-1000; formerly, the tanks had to be filled once a week from supplies delivered by tube-trailer.

The unit generates high-purity hyrogen by electrolysis, the process of breaking down a chemical compound by passing an electric current through it. In this instance, the compound is distilled water, which is separated into hydrogen and oxygen. Water electrolysis has been tried in the past for this type of application, but the ES-1000 is unique in that its electrolyte — the electricity-conducting medium — is a solid plastic membrane; in other electrolysis systems, electrolytes are usually liquid caustic or acid solutions. The GE-developed Solid Polymer





Electrolyte, a membrane about one hundredth of an inch thick, serves as both electrolyte and separator of the hydrogen and oxygen produced. Since the distilled water being broken down is the only liquid in the system, there are no hazardous acids or caustic substances to be handled, monitored or cleaned up. The ES-1000 has an electronic control system that allows unattended operation and automatically shuts the unit down if it is not operating properly; among other advantages are high efficiency for lower operating cost and compact design that reduces installation space.

GE's solid polymer electrolyte technology was originally developed for use in the fuel cell power system of NASA's Gemini manned spacecraft, flown in 1965-66. Under contract to Johnson Space Center, GE has worked for several years to refine the technology and develop a unit for generating oxygen as part of the life support system of a manned space station; the oxygen generator is still being tested. Since 1979, GE has been working with the Electric Power Research Institute and PSE&G in developing the electrolysis system for the utility generator cooling application.

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* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.